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9913658.2

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Cardiff Road
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1. Your reference

EEB/AKW/PAT0056

2. Patent application number
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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

NSK-RHP European Technology Co., Limited
Mere Way
Ruddington Fields Business Park
Ruddington
Nottingham NG11 6JZ

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

UK 06930745001.

4. Title of the invention

"IMPROVEMENTS IN ROLLING ELEMENT BEARINGS"

5. Name of your agent *(if you have one)*

BROOKES & MARTIN

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

High Holborn House
52/54 High Holborn
London WC1V 6SE

Patents ADP number *(if you know it)*

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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a) any applicant named in part 3 is not an inventor, or
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yes

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Continuation sheets of this form	
Description	3
Claim(s)	2
Abstract	
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Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature	Date
Brookes & Martin	11.06.99

12. Name and daytime telephone number of person to contact in the United Kingdom

E.E, Barnard 0171-242-9631

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IMPROVEMENTS IN ROLLING ELEMENTS BEARINGS

The present invention relates to rolling element bearings and, more particularly, the invention relates to improvements in the performance of such bearings by treatment of the individual bearing components - inner ring, outer ring and rolling elements.

It is an object of the present invention to improve the performance of bearings.

According to the invention there is provided a method of treatment of rolling element bearing component, by hard particle abrasion thereby to improve the surface topography of the component.

The process of hard particle abrasion, or ceramic abrasion, is known in the art and hard particle abrasion equipment is commercially available.

Hard particle abrasion of rolling element bearing components may simply involve immersing one or more of the bearing components in a receptacle containing hard particles and usually a fluid. The particles are typically alumina or other ceramics and can vary in size from a few microns to over a millimetre. The hardness of the particles is normally equal to or greater than that of the bearing component to be treated and the fluid is usually water. Corrosion inhibitors may be added to the fluid.

The or each bearing component and/or the hard particles are agitated to give relative movement between the bearing components and the particles. The resulting impact or

action of the hard particles on the surface of the bearing component primarily modifies the topography of the surface and preferably induces beneficial residual compressive stress in the surface. The modified topography hardens or toughens the surface and the residual stress offsets the stresses experienced by the bearing component during use.

The process of hard particle abrasion when applied to bearing components alleviates surface defects that can be introduced, into the component surface for instance, the raceway surface, by conventional grinding and honing. In addition, consistently good surface finishes can be achieved, possibly without the need for expensive finish grinding and honing.

In an example of performing the method of the present invention bearing components are treated for around 30 minutes. The components are supported in a bath containing water and alumina particles of size 10 microns. Relative movement between the bearing components and alumina particles is provided by rotating the components in one direction while the bath is rotated in the opposite direction.

An assessment before and after such abrasion of bearing inner rings made in M50 NiL material shows that the surface finish (Ra) is improved from around 0.1282 to 0.0715 μm. The roundness of the rings was not significantly affected and the material removed per surface was about 4 μm.

Polymet testing of ceramically abraded bearing components made in M50 NiL material gave an improvement in fatigue life of over 12 times that of untreated components.

Measurement of the residual compressive stress in the surface of M50 NiL bearing components shows that ceramic abrasion increases the compressive stress in the surface of the components by several hundred MPa.

The improved surface topography and the residual compressive stress induced in the surface of the bearing components improve the fatigue resistance of the bearing components and consequently the bearing itself. In particular rolling contact fatigue performance is improved.

Rolling element bearings comprising components that have been treated in accordance with the invention may be used where an improvement in bearing performance is required. Particular examples are gas turbine engine main shaft bearings for use in aerospace or other applications.

Claims

1. A method of treatment of a rolling element bearing component by hard particle abrasion of the component, thereby to improve the surface topography of the component.

2. A method according to claim 1, wherein the hard particle abrasion includes the steps of:

immersing the bearing component in a receptacle containing hard particles; and

agitating the bearing component and/or hard particles to produce relative movement therebetween.

3. A method according to claim 2, wherein the receptacle also contains a fluid.

4. A method according to claim 3, wherein the fluid is water.

5. A method according to claim 3, wherein the fluid is water with a corrosion inhibitor.

6. A method according to any one of claims 2 to 5, wherein the hard particles comprise alumina.

7. A method according to any one of claims 1 to 6, wherein residual compressive stress is induced into the surface of the bearing component.

8. A method according to claim 7, thereby increasing the compressive stress in the surface of the component by several hundred MPa.

9. A method according to any one of claims 1 to 8, wherein the component is a ring with a raceway and the treatment leaves a consistent and smooth finish on the raceway which requires little or no further grinding or honing.

10. A method according to any one of claims 1 to 9, thereby improving the surface finish of the component from around 0.1282µm to 0.0715µm.

11. A method according to any one of claims 1 to 10, wherein the treatment is performed on more than one bearing component.

12. A method substantially as described herein.

13. A rolling element bearing component produced by any one of the preceding claims.

14. A rolling element bearing comprising one or more components according to claim 13.